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Terahertz conductivity of magnetoexcitons and electrons in semiconductor nanostructures

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Abstract

Using terahertz time-domain spectroscopy we investigate how quantum, magnetic and electrostatic confinement alters the photoconductivity of nanostructured semiconductors. In 2.0 THz and 2.9THz GaAs/AlGaAs quantum cascade structures under a magnetic field we observe transitions from the 1s to 2p- or 2p+ magneto-exciton states. The electron cyclotron resonance is prominent at high excitation fluence. Additionally, we report that the conductivity of photoexcited electrons in nanoporous InP honeycombs obeys the Drude model of free-carrier absorption, while the dark conductivity does not. This finding can be explained as a result of surface band bending spatially separating photoexcited electrons and holes, and also accounts for the long electron recombination lifetime (exceeding 100 ns) at low temperature.